(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 121 626**
B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **03.01.90**

(51) Int. Cl.[5]: **H 05 K 13/02**

(21) Application number: **83306624.4**

(22) Date of filing: **31.10.83**

(54) **Method and apparatus for straightening and aligning leads and testing electrical functioning of components.**

(30) Priority: **11.04.83 US 483700**

(43) Date of publication of application:
17.10.84 Bulletin 84/42

(45) Publication of the grant of the patent:
03.01.90 Bulletin 90/01

(84) Designated Contracting States:
AT BE CH DE FR GB IT LI LU NL SE

(56) References cited:
US-A-4 327 483
US-A-4 367 584

(73) Proprietor: **UNIVERSAL INSTRUMENTS CORPORATION (Delaware Corp.)**
P.O. Box 825
Binghamton New York 13902-0825 (US)

(72) Inventor: **Foster, James E.**
1003 Park Manor Boulevard
Endwell New York 13760 (US)

(74) Representative: **Allen, Oliver John Richard et al**
Lloyd Wise, Tregear & Co. Norman House
105-109 Strand
London, WC2R 0AE (GB)

EP 0 121 626 B1

Courier Press, Leamington Spa, England.

Description

This invention relates to a method and apparatus for handling single in-line components hereafter referred to as "SIP components". Such components have a qenerally parallelepiped body and a single series of in-line leads protruding from one surface of the body.

Although particularly directed to handling of SIP components, it is contemplated that certain facets of the disclosure are applicable to other types of components.

U.S. Patent Specification No. 4,327,483 discloses an apparatus for sequentially selecting and transporting SIP components and inserting them into a printed circuit board and the disclosure thereof is incorporated herein by reference. During handling, the leads of such components can easily be bent relative to a longitudinal axis for each lead, causing the subsequent misinsertion of the leads into corresponding holes of the circuit board. Further, there is a need for automated handling of such components in which testing of electrical functioning of these components is performed during the handling. U.S. Patent Specification No. 4,367,584 describes an arrangement in which the free ends of the in-line leads on each side of a dual-in-line packaged component being prepared for insertion into a PC8 are pressed symmetrically sideways and in an outward direction against an outer member, by a pair of blades (72). The outer member on each side has a plurality of parallel longitudinal grooves, corresponding to the in-line leads, which receive the latter when they are displaced by the respective blade and which have the effect of straightening and aligning the leads along the axes of the grooves. This action also brings the leads into electrical contact with an array of electrodes embedded in the grooves which apply signals to the leads in order to perform tests on the component. However, the method and apparatus of this patent are not readily adaptable to the handling of SIP components which have only a single line of leads.

In the present invention there is provided an automated method of sequentially handling electrical components of the type having a body and a single row of in-line leads projecting from said body, each of said leads having a longitudinal axis, said method characterised by the steps for each of the components of: inserting said leads in holes of a block and providing relative movement between said leads and said block along said longitudinal axis, mechanically straightening each of the leads which is bent along said axis during said inserting and moving whilst aligning the leads substantially parallel to each other in a row, and testing electrical functioning of the component substantially simultaneously with said straightening and aligning, whereby a faulty component may be rejected, all prior to installation thereof, e.g., in a respective circuit board.

The invention also provides an apparatus for performing the above-mentioned method which comprises a block and means for inserting said leads in holes of the block and providing relative movement between said leads and said block along said longitudinal axis for straightening and mechanically aligning the leads of each component substantially parallel to each other in a row, and means for testing electrical functioning of the component substantially simultaneously with said straightening and aligning.

This apparatus aligns the axes of leads of a component, whether or not the leads are perpendicular to the surface from which they protrude, so as to align tips of the leads and provide references for locating these tips for subsequent insertion into corresponding holes of a printed circuit board. The testing function is made to sense the presence and absence of straightened leads, thereby ascertaining whether or not such a component is physically acceptable for insertion into a circuit board.

In a preferred embodiment of the invention, selected components are sequentially transferred from a plurality of supply magazines by a shuttle assembly and transported to a shuttle unload station at which a vertical transfer assembly transfers the components from the shuttle assembly to a gauging station containing the aforesaid block. At the gauging station, the component is clamped to secure it and to locate the leads for subsequent engaging thereof by the block. During the gauging operation, bent leads of the component are straightened and electrical functioning of the component is tested. Thereafter, the body of the component is sandwiched between the gauging block and an insert head vacuum block and the gauging block is retracted. The clamping assembly allows retraction of the gauging block without dislodging the component from the vacuum block and also allows a rotation of the vacuum block to an insert position without loss of the component due to inertia or the like. Subsequent thereto, the component is mounted on a printed circuit board by inserting the leads thereof into corresponding holes of the circuit board.

This process is repeated until all the needed components have been inserted into the circuit board, whereupon another board is placed on a pantograph and the cycle is started over.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a schematic, side elevation illustrating the positioning of the various main assemblies relative to each other during handling of a SIP.

Figure 2 is a top plan view of a shuttle assembly.

Figure 3 is a right side elevation of the shuttle assembly of Figure 2.

Figure 4 is a front elevational view of a vertical transfer assembly.

Figure 5 is a right side elevation of the device of Figure 4.

Figure 6 is a top plan view of the device of Figure 4.

Figure 7 is a right side elevation of a lead straightener/function verifier assembly.

Figure 8 is a top plan view of the device of Figure 7.

Figure 9 is a front elevation of the device of Figure 7.

Figure 10 is a front elevation of the insert head assembly partially in section and with parts thereof broken away for clarity.

Figure 11 is a right side elevation of the device of Figure 10, with parts thereof broken away for clarity.

Figure 11A is a partial, enlarged view of an insert head vacuum block shown in Figure 11 to illustrate a beveled component engaging portion.

Figure 12 is a front elevation of the clamp assembly portion of the insert head assembly of Figures 11 and 11A.

Figure 13 is a right side elevation of the device of Figure 12.

Figure 14 is an enlarged left side elevation, partial cross-section illustrating the lead straightener holes and verifier electrical contacts for the assembly of Figure 7.

Figure 15 is a cross-sectional view illustrating tapered entrances to the lead straightener holes shown in Figure 14.

Figures 16 and 17 are perspective views of SIP components.

Referring to Figures 7-9, a piston-cylinder 16 of a lead straightener means 2 is attached to reciprocating slide 20, via floating coupling 19 and bracket 18 for extension of the traction along axis 13 (see Figure 8). Slide 20 has an electrically insulative block 22 attached to the top thereof and straddles a fixed, center guide 14. Center guide 14 is attached to a fixed base plate 12, to which cylinder 16 is also affixed via bracket 17. A front end of insulative block 22 is provided with slots 23 (as seen in Figure 8) and a lead straightener block 25. Slots 23 are for reception of flexible electrical contacts 24 (Figures 7 and 14) forming part of a means 3 for testing electrical functioning of SIP components which contacts are biased against the back of holes 26 of a straightener block 25 as seen in Figure 14. A photocell sensor arrangement 28A, 28B, 28C is attached to frame 12 for sensing three different positions of extension or retraction of slide 20. To facilitate such sensing, a vein 27 has apertures (not shown) appropriately arranged along the length thereof and is attached to slide 20 by bracket 21. The front (to the left in Figures 7 and 8) of frame 12 has a clamping cylinder 32 attached thereto for reciprocation of a clamp block 34 along axis 31 of Figure 8. Clamp block 34 slides on a horizontal surface 38 to clamp a component between the front surface 35 of clamp block 34 and locator surface 40 in opposition thereto, as will be explained further. A magnet 48 (Figure 8) is reciprocatable with clamp block 34 and cooperates with Hall effect sensors 44 and 46 to detect the extended and retracted positions of clamp block 34.

Referring further to Figures 14-17, lead straightening/aligning block 25 has a series of holes 26 with conical-shaped lead-in portions 26' for receiving and guiding leads into holes 26 such that the tips of the leads of a component 100 will engage flexible leaf-spring contacts 24 in order that a test function may be performed; and block 25 is electrically insulated by a coating or by forming it from a ceramic, plastic or the like. With this arrangement, the leads are straightened, or at least aligned parallel to each other so that contact of the tips of the leads with electrical contacts 24 allows the sensing of the presence and absence of the various leads as well as testing of the electrical functioning of component 100 via a connection of between electrical contacts 24 and a controller (not shown). The controller typically may comprise a programmable computer.

Located above horizontal surface 38 is a vertical transfer assembly 50 as schematically illustrated in Figure 1. The structure of vertical transfer assembly 50 may be seen in Figures 4-6 in which a bracket 53 is attached to a cylinder 57 to support it on a machine frame such as a typical C-frame. Accordingly, cylinder 57 is fixed relative to the machine frame and actuation thereof provides for a vertical reciprocation of vacuum tubes 54 in the direction of arrows 51. The top ends of tubes 54 are connected to vacuum supply hoses (not shown) in a well known manner, and the bottom ends of tubes 54 have the typical flexible tips attached thereto. Guide rods 55 ensure proper reciprocation of vacuum tubes 54 relative to bracket 53 under the control of cylinder 57. A magnet 58 cooperates with a pair of Hall effect sensors to indicate the extended and retracted positions of tubes 54.

Figures 2 and 3 illustrate a Shuttle assembly 80 (similar to that disclosed in the above referenced U.S. Patent No. 4,327,483) for pick-up of the SIP components 100 from a selected magazine 90 (shown schematically in Figure 1) and transport thereof to vertical transfer assembly 50. A general functioning of Shuttle assembly 80 is well illustrated and explained in the above cross-reference U.S. Patent No. 4,327,483 and comprises a main body 81 to which is pivotally attached an arm 83 having an extensible and retractable clamp assembly comprising a retriever 82 and a clamp 84. Extension of Clamp 84 is limited by a guide bolt 85 threaded into body 81 such that a spring 86 biases clamp 84 to its fully extended position. Retriever 82 is extensible and retractable relative to body 81 via a well known piston/cylinder arrangement. Extension of retriever 82 further than that shown in Figures 2 and 3 opens the clamp assembly for reception of a SIP and, during retraction thereof, the SIP is sandwiched or clamped between retriever 82 and clamp 84 under the bias of the spring 86.

Figures 10 and 11 illustrate an insert head assembly similar to that disclosed in the above cross-referenced U.S. Patent No. 4,327,483. An insert head 60 is pivotal about axis 61 and comprises a vacuum block 62 which is extensible and retractable in the direction of arrows 63 of Figure 11. Referring to Figure 11A, vacuum block 62 has a vacuum hose attachment 65 and a tapered surface 64 for purpose which will become

apparent from the following description of the operation of the overall apparatus. Insert head 60 also comprises a clamp assembly 66 (Figures 10-13) for clamping the body of a SIP against vacuum block 62. Clamp assembly 66 has a clamp member 68 pivotal about axis 67 and biased to the unclamped position of Figure 13 by compression spring 70. Actuation cylinder 72 has a piston rod 74 to the end of which is attached a hardened steel nose piece 76 for engaging clamp member 68 and pivoting it to the clamping position against the biasing of spring 70.

The generalized sequence of operation involves movement of Shuttle assembly 80 to a selected magazine 90, extraction of a SIP 102 from the magazine and transport of SIP 102 to a position underneath vertical transfer assembly 50. SIP 102 is engaged by one or more vacuum tubes 54 of vertical transfer assembly 50 (according to the length of body 101) for removing SIP 102 from Shuttle 80 and transferring it downwardly to horizontal surface 38 of testing station 10. At testing station 10, side clamp cylinder 32 is actuated to engage body 101 of SIP 102 and force it against locator surface 40 such that the leads 106 of SIP 102 are properly located relative to lead straightening holes 26 of tester station 2. At this time, vertical transfer vacuum tubes 54 are retracted, insert head 60 pivots to position the tooling thereof in a horizontal position, and vacuum block 62 of insert head 60 is extended into engagement with SIP 102 while slide 20 is moved to a first extended position by cylinder 16 such that leads 106 are guided into straightening holes 26 by lead-in portion 26' of straightener/aligner block 25 and body 101 of SIP 102 is sandwiched between vacuum block 62 and straightener/aligner block 25. The front portion of vacuum block 62 is beveled so that body 101 of SIP 102 is firmly engaged against horizontal surface 38, without damage, if the body 101 is not already fully engaged with surface 38. The tips of straightened leads 106 engage flexible leaf-spring contacts 24 which are located behind block 25 (as seen in Figure 14). Having straightened leads 106 and tested the electrical functioning of SIP 102 via leads 106 thereof, side clamp 34 is retracted, and slide 20 is extended along with retraction of vacuum block 102 (generally in the direction of axis 13) to transfer SIP 102 away from test station 10. Thereafter clamping cylinder 72 is actuated, such that pivotal clamp 68, engages body 101 of SIP 102 to clamp SIP 102 onto vacuum block 62, and slide 20 is fully retracted. At this time, insert head 60 is pivoted to position the tooling thereof in the vertical position of Figure 1, with the body of SIP 102 sandwiched between vacuum block 62 and pivotal clamp 68. Then clamp 68 is pivoted out of engagement with SIP body 101 and insert head 60 is actuated to insert leads 106 of SIP 102 into corresponding holes of a printed circuit board.

A specific operation of the apparatus is described in the steps:

(1) Shuttle 80 moves to a selected magazine 90 with the tooling thereof pivoted downwardly and partially extended;

(2) the tooling of Shuttle assembly 80 fully extends;

(3) the tooling of Shuttle assembly 80 raises;

(4) retriever 82 retracts to extract SIP 102 from magazine 90 and clamp the body thereof between retriever 82 and clamp 84 under the bias of spring 86;

(5) the tooling of Shuttle assembly 80 is lowered and a check is performed for the presence or absence of a component in the tooling. If the check is negative, three more attempts are initiated to retrieve a component from the selected magazine or an alternative magazine. If, after the three attempts, no component has been retrieved by the tooling of Shuttle assembly 80, then the machine is stopped and the operator is notified by an alarm. If the check for a component is positive; then

(6) shuttle 80 moves to a position adjacent vertical transfer assembly 50;

(7) the tooling of Shuttle assembly 80 is extended and the vacuum of transfer assembly 50 is turned on;

(8) the tooling of Shuttle assembly 80 is raised to contact the body 101 of SIP 102 with vacuum head 56 of vertical transfer assembly 50;

(9) retriever 82 of Shuttle assembly 80 is further extended to unclamp the SIP, a piezoelectric transducer-type vacuum switch senses whether or not a SIP is supported by vacuum head 56 of vertical transfer assembly 50, and a "part missing" function similar to that described above is performed if a component is not supported by vacuum head 56. If a component is supported by vacuum head 56; then

(10) the tooling of Shuttle assembly 80 is lowered; and

(11) shuttle 80 moves to the next selected magazine 90.

The above described steps (3-11) are repeated in concert with the following steps (12-20).

(12) Vacuum tubes 54 of vertical transfer assembly 50 are extended downwardly;

(13) side clamp cylinder 32 of test station 10 is extended, and the vacuum of vertical transfer assembly 50 is turned off. Hall effect sensor 44 will be actuated if a SIP 102 is not appropriately captured between clamp block 34 and locater surface 40. With SIP 102 appropriately captured by extension of side clamp block 34;

(14) vacuum tubes 54 of vertical transfer assembly are retracted and the tooling of insert head assembly 60 is rotated to the horizontal position indicated in phantom lines in Figure 1;

(15) vacuum block 62 of the insert head is extended;

(16) slide 20 of test station 10 is extended to a first position such that leads 106 of SIP 102 are guided into straightening holes 26 and electrical functioning of SIP 102 is performed (through leads 106 via flexible leaf contacts 24 and associated circuitry). The vacuum of vacuum block 62 is turned on;

(17) side clamp block 34 is retracted;

(18) the pressure under which vacuum block 62 has been extended is lowered, and slide 20 is further extended to a second position so that SIP 102 clears horizontal surface 38 of the test station 10;

(19) clamp 68 of clamping assembly 66 is pivoted into engagement with body 101 of the SIP 102, which is being held by the vacuum on vacuum block 62 and by the sandwiching of body 101 between vacuum block 62 and straightening/aligning block 25 of slide 20;

(20) slide 20 is retracted. During this retraction of slide 20, leads 106 remain parallel to each other during the sliding disengagement thereof from holes 26 of block 25. If, for some reason, leads 106 are not exactly perpendicular to the surface of the body 101 from which they protrude, it will not matter since the tips of the parallel leads will be equally spaced and located relative to holes 26 of block 25 which, in their fully retracted position, are reference locations for positioning the corresponding circuit board holes beneath insert head 60. Thus, the tips of leads, 106 if not the full lengths of the leads, will be properly positioned relative to the corresponding circuit board holes into which they are to be inserted. If the test results have been negative, i.e., all the leads have not been straightened and tested or electrical functioning of SIP 102 is unsatisfactory, then the component will be removed from vacuum block 62 such that a faulty component will not be mounted on the circuit board.

During the next three steps (21-23), the above described steps (3-5) and (12-14) are performed in conjunction therewith.

(21) Insert head 60 is pivoted to the insert position, while the printed circuit board is properly positioned and a clinching mechanism under the printed circuit board is opened to receive leads 106 of SIP 102.

(22) Clamp 68 is pivoted away from SIP 102 such that only vacuum block 62 is holding SIP 102.

(23) The insert head is extended to insert leads 106 into the corresponding holes of the circuit board, and clinching of the leads to the underside thereof is performed.

Testing of the component for electrical functioning should be understood to include testing for proper orientation of the component.

Typically during straightening and testing, vacuum block 62 is extended with 80 pounds (5.6 Kg/cm^2) of fluid pressure while slide 20 is extended with 10 pounds (0.7 Kg/cm^2) of fluid pressure; whereas, during transfer of the SIP from the test station, 20 pounds (1.4 Kg/cm^2) of extension pressure is applied to vacuum block 62 and 60 pounds (4.2 Kg/cm^2) to slide 20. It has been found that these pressures prevent breakage of the stand-offs of the components.

In cases where the component bodies 101 vary in thickness, from component to component, the lead straightening operation may cause all of the leads 106 to be parallel to each other but not perpendicular to the surface of body 101 from which they protrude. In fact, because of manufacturing inconsistencies, a body 101 may vary in thickness from end to end, causing a similar situation where the leads 106 are parallel to each other and not perpendicular to the body surface. However, by the instant invention, the tips of the straightened leads still will be located properly for subsequent insertion when either of these situations occur.

Claims

1. An automated method of sequentially handling electrical components of the type having a body and a single row of in-line leads projecting from said body, each of said leads having a longitudinal axis, said method characterised by the steps for each (102) of the components of:-

inserting said leads in holes of a block and providing relative movement between said leads and said block along said longitudinal axis, and mechanically straightening each of the leads which is bent along said axis during said inserting and moving whilst aligning the leads (106) substantially parallel to each other in a row; and testing electrical functioning of the component substantially simultaneously with said straightening and aligning, whereby a faulty component may be rejected,

all prior to installation thereof, e.g., in a respective circuit board.

2. A method as in Claim 1, and further characterised by the step of locating tips of said leads during said aligning as a reference for subsequent insertion of the leads into corresponding holes of a circuit board.

3. A method as in Claim 1 or Claim 2, and further characterised by the step of locating a reference lead of said component prior to said aligning and testing.

4. A method as in any preceding claim, and further characterised by the step of guiding tips of said leads during said aligning.

5. A method as claimed in any preceding claim comprising the step of rejecting a component if the results of said testing are unsatisfactory.

6. An apparatus for performing the automated method, according to any one of the claims 1-5, of sequentially handling electrical components of the type having a body and a single row of in-line leads projecting from said body, each of said leads having a longitudinal axis, said apparatus caracterised by:

a block (25) and means for inserting said leads in holes of the block and providing relative movement between said leads and said block along said longitudinal axis and for straightening and mechanically aligning the leads of each component substantially parallel to each other in a row during said inserting and moving; and

means (24) for testing electrical functioning of the component substantially simultaneously with said straightening and aligning.

7. An apparatus as in Claim 6, and further

characterised by means (26, 26') for locating tips of the leads (106) during said straightening and aligning as a reference for subsequent insertion of said leads into corresponding holes of a circuit board.

8. An apparatus as claimed in Claim 6 or Claim 7 and further characterised by having:

means (80, 50) for transporting a selected component (102) to a test station (10);

means (25, 62) for transferring said component from the test station upon completion of said testing to an assembly station at which said leads are inserted into corresponding holes of a circuit board; and means for controlling said transporting means and said transferring means.

9. An apparatus as in Claim 8, wherein said transferring means comprises a gauge block (25) and a co-operable vacuum block (62) of an insert head (60), the gauge block and vacuum block arranged to move in concert, with the component body (102) sandwiched therebetween, during transferring of a component from the test station (10).

Patentansprüche

1. Automatisierte Methode zur aufeinanderfolgenden Handhabung elektrischer Bauteile in einer Ausführung, die einen Körper und eine einzelne Reihe hintereinander angeordneter Anschlußstifte, die aus dem genannten Körper herausragen, umfaßt, wobei jeder der genannten Anschlußstifte eine Längsachse aufweist, wobei die genannte Methode dadurch gekennzeichnet ist, daß sie für jedes (102) der Bauteile folgende Schritte umfaßt:

Einführen der genannten Anschlußstifte in Löcher eines Blocks und Schaffung einer relativen Bewegung zwischen den genannten Anschlußstiften und dem genannten Block entlang der genannten Längsachse sowie das mechanische Geraderichten eines jeden Anschlußstifts, der entlang der genannten Achse gebogen ist, während des genannten Einführens und während der Bewegung, wobei die Anschlußstifte (106) im wesentlichen parallel zueinander in einer Reihe ausgerichtet sind; und

Überprüfen der elektrischen Funktion des Bauteils, wobei das Überprüfen im wesentlichen gleichzeitig mit dem genannten Geraderichten und Ausrichten erfolgt, so daß ein fehlerhaftes Bauteil ausgesondert werden kann,

wobei alle Schritte erfolgen, bevor das Bauteil z.B. in eine entsprechende Platine eingebaut wird.

2. Methode gemäß Anspruch 1 und weiterhin gekennzeichnet durch den Schritt des Festlegens der Spitzen der genannten Anschlußstifte während des genannten Ausrichtens als Bezugspunkt für das nachfolgende Einführen der Anschlußstifte in die entsprechenden Löcher einer Platine.

3. Methode gemäß Anspruch 1 oder Anspruch 2 und weiterhin gekennzeichnet durch den Schritt des Festlegens eines Bezugsanschlußstifts des genannten Bauteils vor dem genannten Ausrichten und vor der Prüfung.

4. Methode gemäß irgendeinem der vorstehenden Ansprüche und weiterhin gekennzeichnet durch den Schritt des Führens der Spitzen der genannten Anschlußstifte während des genannten Ausrichtens.

5. Methode gemäß irgendeinem der vorstehenden Ansprüche, umfassend den Schritt des Aussonderns eines Bauteils, wenn die Ergebnisse der genannten Prüfung nicht zufriedenstellend sind.

6. Apparat zur Durchführung der automatisierten Methode, gemäß irgendeinem der Ansprüche 1 bis 5, zur aufeinanderfolgenden Handhabung elektrischer Bauteile in einer Ausführung, die einen Körper und eine einzelne Reihe hintereinander angeordneter Anschlußstifte, die aus dem genannten Körper herausragen, umfaßt, wobei jeder der genannten Anschlußstifte eine Längsachse umfaßt, wobei der genannte Apparat durch folgende Teile gekennzeichnet ist:

Block (25) und Vorrichtung zum Einführen der genannten Anschlußstifte in Löcher des Blocks und Schaffung einer relativen Bewegung zwischen den genannten Anschlußstiften und dem genannten Block entlang der genannten Längsachse sowie zum Geraderichten und mechanischen Ausrichten der Anschlußstifte eines jeden Bauteils im wesentlichen parallel zueinander in einer Reihe während des genannten Einführens und während der Bewegung; und

Vorrichtung (24) zur Prüfung der elektrischen Funktion des Bauteils im wesentlichen gleichzeitig mit dem genannten Geraderichten und Ausrichten.

7. Apparat gemäß Anspruch 6 und weiterhin gekennzeichnet durch eine Vorrichtung (26, 26') zur Festlegung der Spitzen der Anschlußstifte (106) während des genannten Geraderichtens und Ausrichtens als Bezugspunkt für das nachfolgende Einführen der genannten Anschlußstifte in entsprechende Löcher einer Platine.

8. Apparat gemäß Anspruch 6 oder Anspruch 7 und weiterhin durch folgende Teile gekennzeichnet:

Vorrichtung (80, 50) für den Transport eines ausgewählten Bauteils (102) zu einer Prüfstation (10);

Vorrichtung (25, 62) für den Weitertransport des genannten Bauteils von der Prüfstation nach Beendigung der genannten Prüfung zu einer Montagestation, in der die genannten Anschlußstifte in entsprechende Löcher einer Platine eingeführt werden; und

Vorrichtung zur Kontrolle der genannten Transportvorrichtung und der genannten Weitertransportvorrichtung.

9. Apparat gemäß Anspruch 8, wobei die genannte Weitertransportvorrichtung einen Meßblock (25) und einen zusammenwirkenden Vakuumblock (62) eines Einführungskopfes (60) umfaßt, wobei der Meßblock und der Vakuumblock so angeordnet sind, daß sie sich während des Weitertransports eines Bauteils von der Prüfstation (10) gemeinsam bewegen, wobei sich der Bauteilkörper (102) in Sandwichanordnung dazwischen befindet.

Revendications

1. Procédé automatique de manipulation séquentielle de composants électriques comportant un corps et une rangée de fils en ligne en saillie sur le corps, chacun desdits fils ayant un axe longitudinal, le procédé étant caractérisé par les étapes suivantes pour chacun des composants (102) consistant en:

l'insertion desdits fils dans des trous d'un bloc, la création d'un déplacement relatif le long dudit axe longitudinal entre les fils et le bloc et le redressement mécanique de chaque fil qui aurait été plié par rapport à l'axe lors de l'insertion et du déplacement, avec l'alignement simultané des fils en substance parallèlement les uns aux autres dans une rangée, et

le test de fonctionnement électrique du composant en substance simultanément avec le redressement et l'alignement, en vue de permettre la mise au rebut de tout composant défectueux,

tout ceci précédant le montage du composant, par exemple dans une plaquette de circuits imprimés.

2. Procédé suivant la revendication 1, caractérisé en outre par l'étape consistant en la localisation des extrémités desdits fils pendant leur alignement à titre de repères de référence pour l'insertion ultérieure des fils dans des trous correspondants d'une plaquette de circuits imprimés.

3. Procédé suivant les revendications 1 et 2, caractérisé en outre par l'étape consistant en la localisation d'un fil de référence dudit composant avant l'alignement et le test.

4. Procédé suivant l'une quelconque des revendications précédentes, caractérisé en outre par l'étape consistant à guider les extrémités desdits fils pendant l'alignement.

5. Procédé suivant l'une quelconque des revendications précédentes, comprenant l'étape de mise au de rebut d'un composant si les résultats du test sont insatisfaisants.

6. Appareil pour exécuter le procédé automatique suivant l'une quelconque des revendications 1 à 5, de manipulation séquentielle de composants électriques du type comportant un corps et une rangée de fils en ligne en saillie sur le corps, chacun desdits fils ayant un axe longitudinal, l'appareil étant caractérisé par:

un bloc (25) et des moyens pour insérer les fils dans le bloc et créer un déplacement relatif entre les fils et le bloc le long dudit axe longitudinal et pour redresser et aligner mécaniquement les fils de chaque composant en substance parallèlement les uns aux autres dans une rangée pendant l'insertion et le déplacement, et

des moyens (24) pour l'exécution du test de fonctionnement électrique du composant en substance en même temps que le redressement et l'alignement.

7. Appareil suivant la revendication 6, caractérisé en outre par des moyens (26, 26') pour localiser les extrémités des fils (106) lors du redressement et de l'alignement, à titre de repères de référence pour l'insertion ultérieure desdits fils dans des trous correspondants d'une plaquette de circuits imprimés.

8. Appareil suivant la revendication 6 ou 7, caractérisé en outre en ce qu'il comprend:

des moyens (80, 50) pour transporter un composant sélectionné (102) vers un poste de test (10);

des moyens (25, 62) pour transférer le composant du poste de test lorsque le test est terminé vers un poste de montage où les fils sont insérés dans des trous correspondants d'une plaquette de circuits imprimés, et

des moyens pour commander les moyens de transport et de transfert.

9. Appareil suivant la revendication 8, dans lequel les moyens de transfert comprennent un bloc gabarit (25) et un bloc ventouse coopérant (62) d'une tête d'insertion, le bloc gabarit et le bloc ventouse étant faits pour se déplacer ensemble avec le corps du composant (102) maintenu entre eux pendant le transfert d'un composant à partir du poste de test (10).

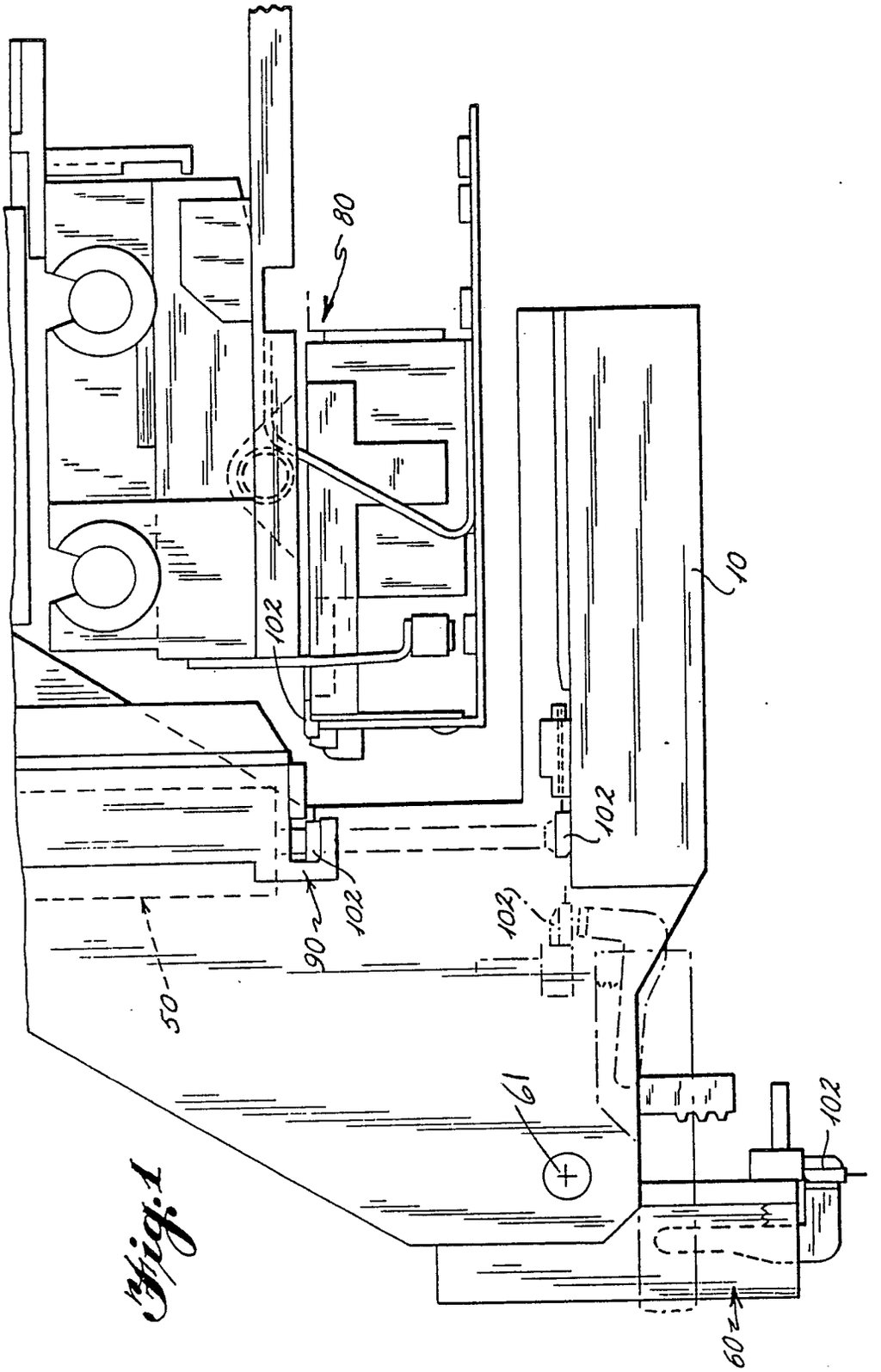

Fig. 1

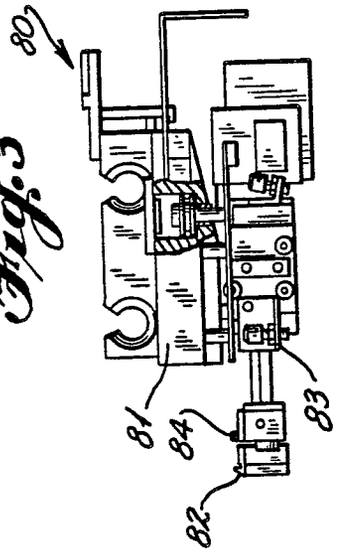

Fig. 3

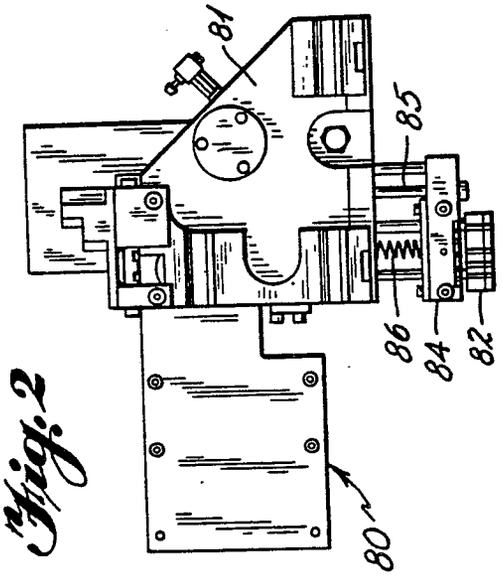

Fig. 2

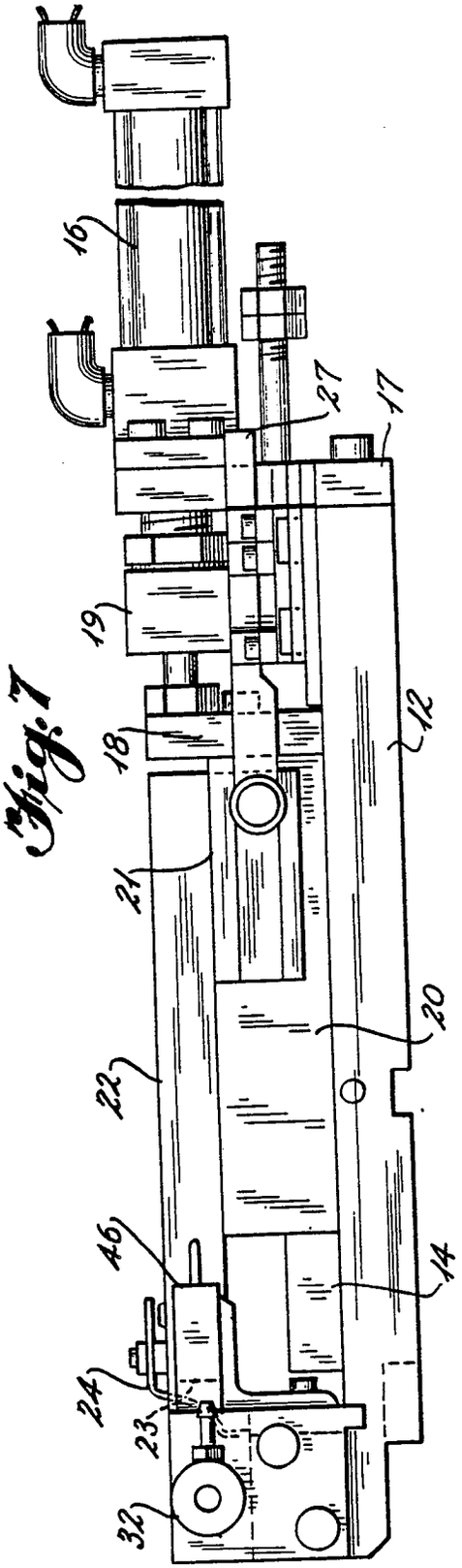

Fig. 1

Fig.4

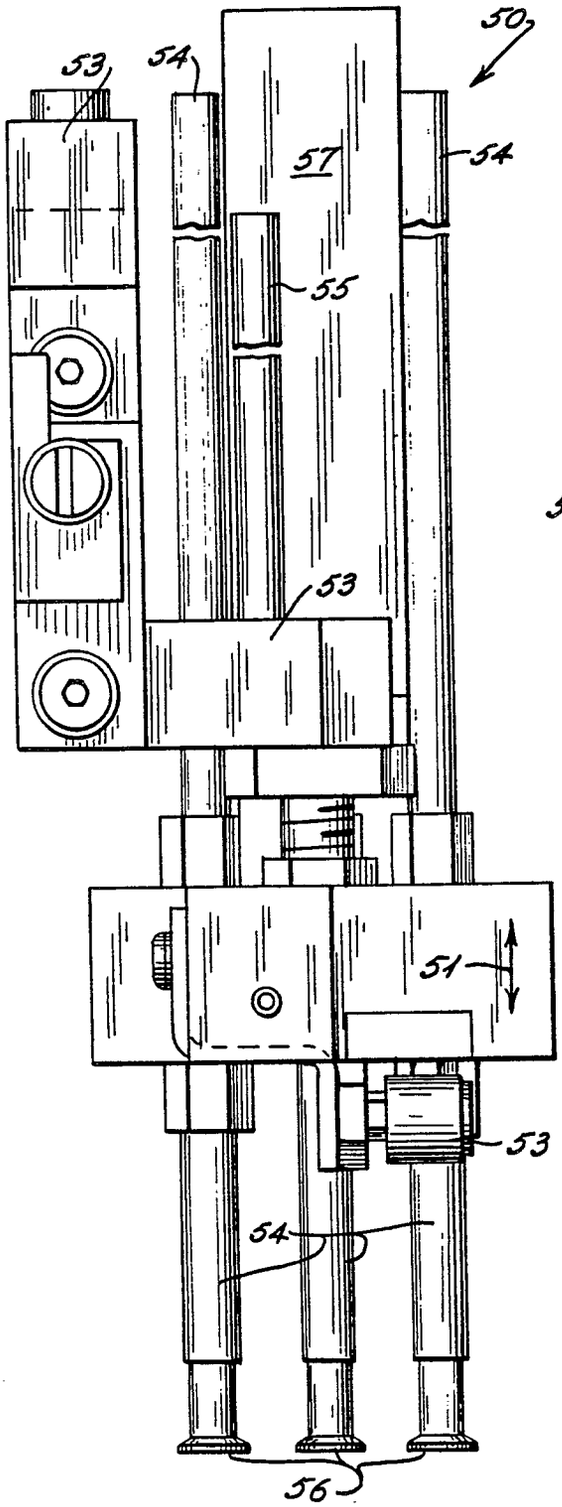

Fig.5

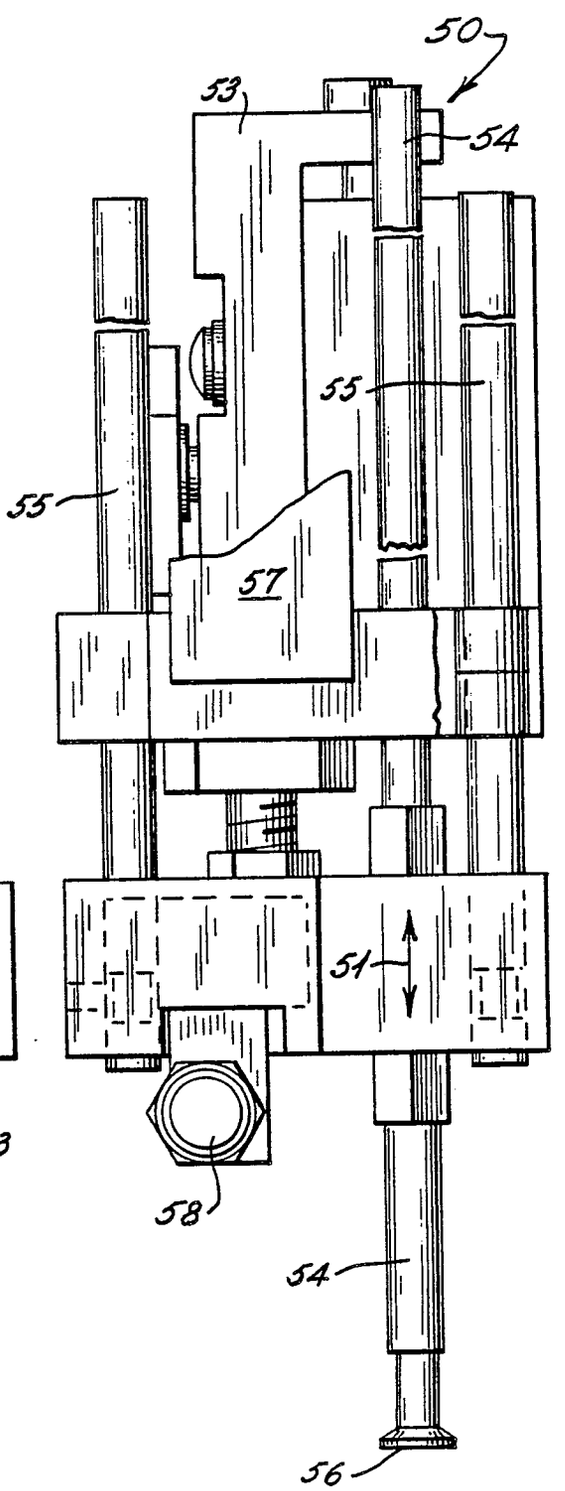

Fig.11

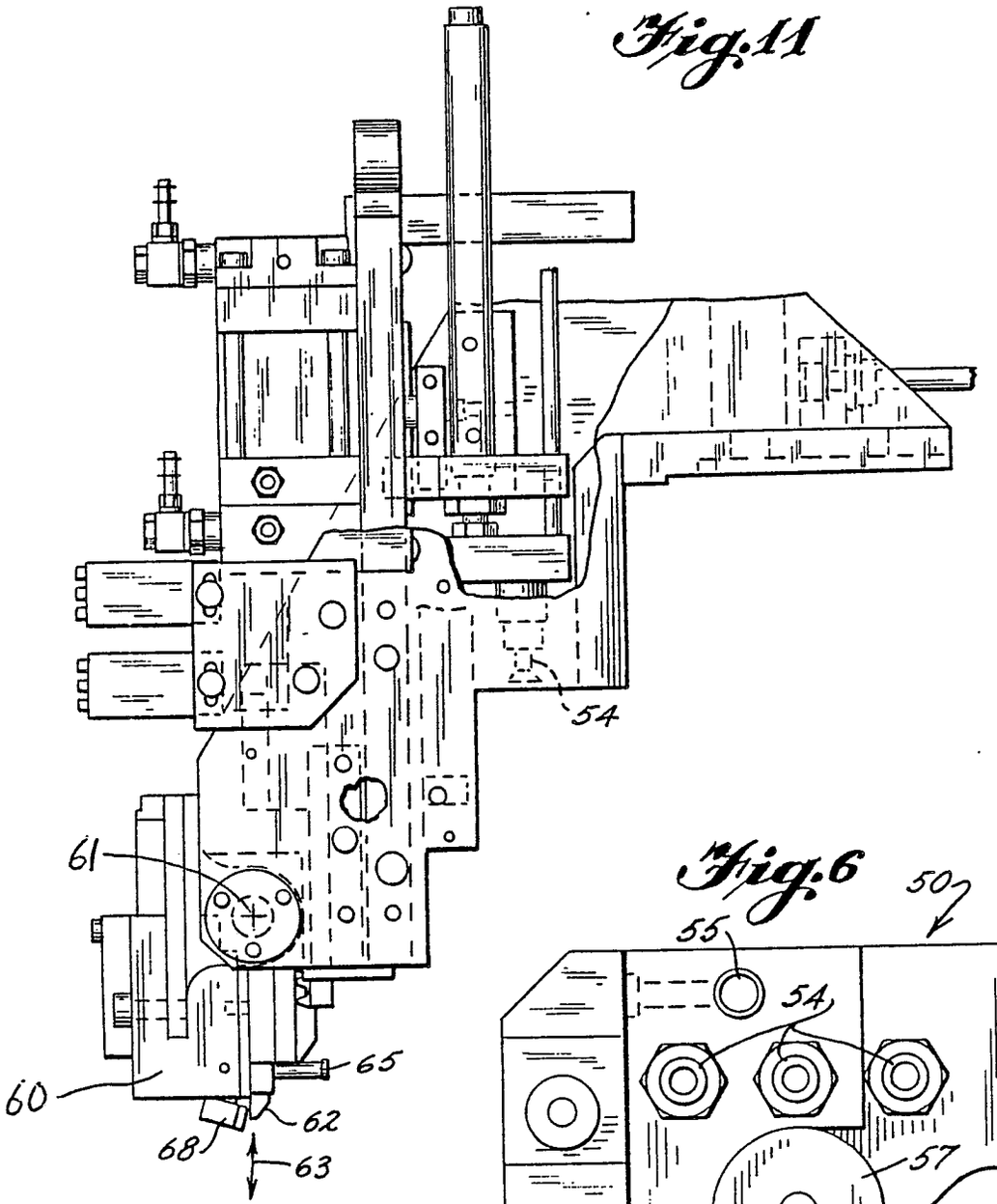

Fig.6

Fig. 8

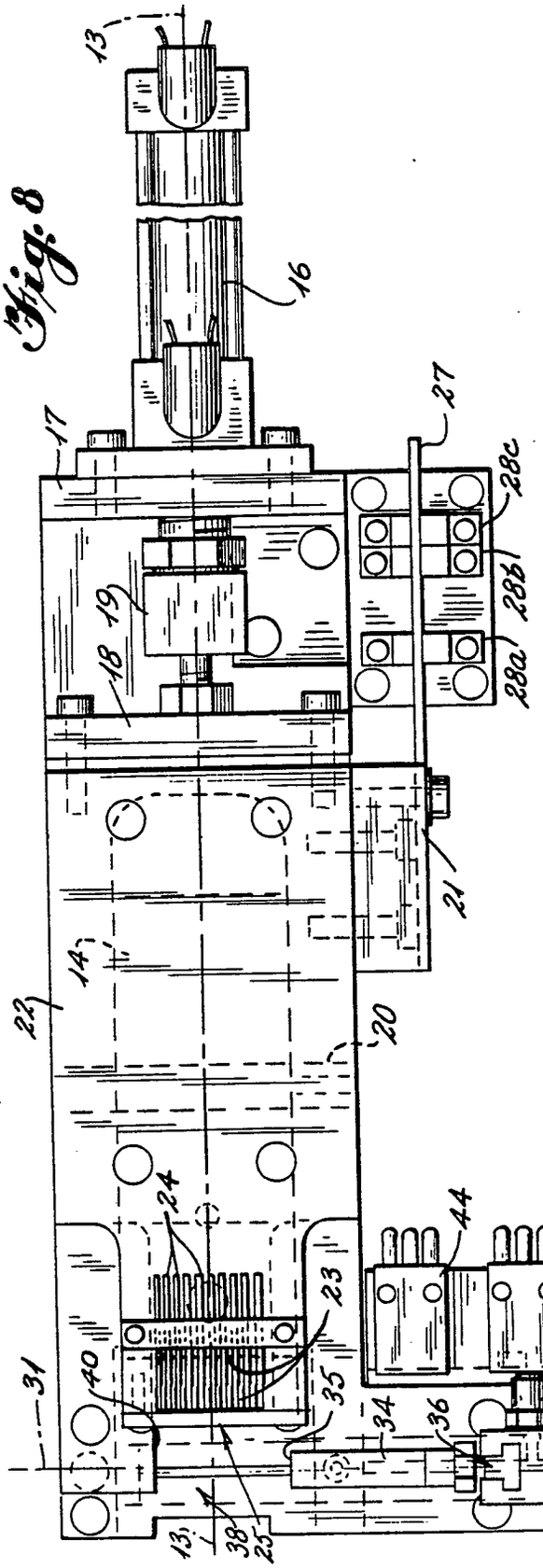

Fig. 13

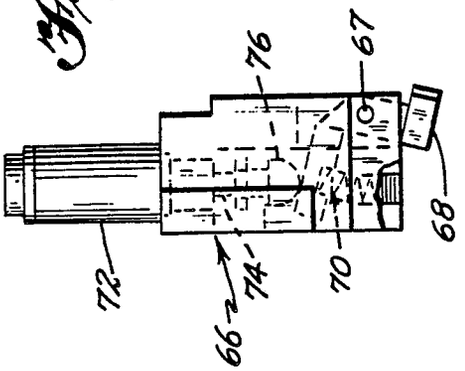

Fig. 12

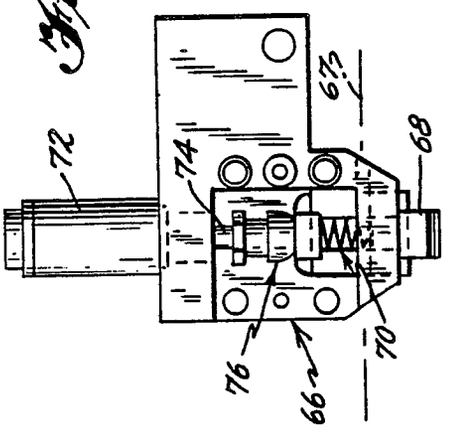

Fig.9

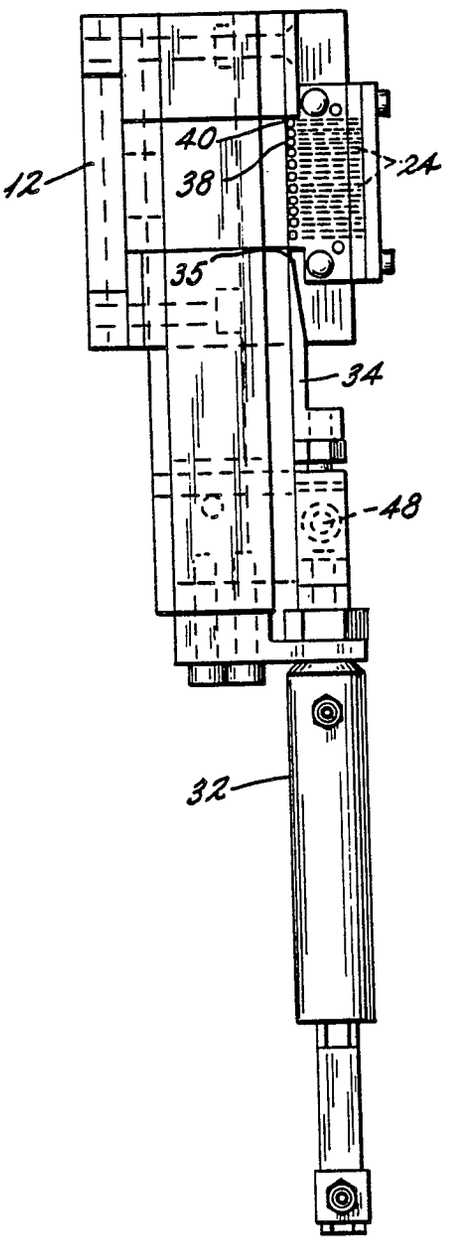

Fig.10

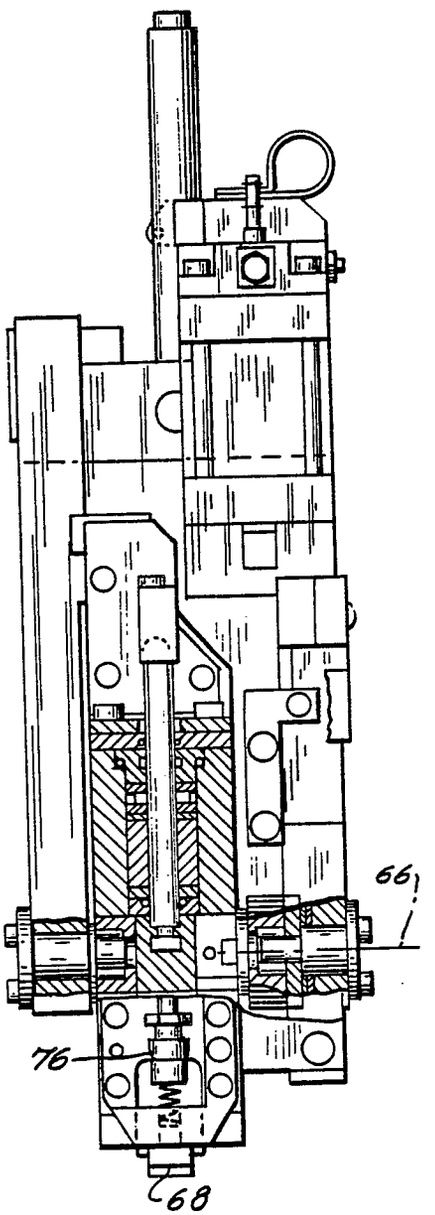

Fig.11a

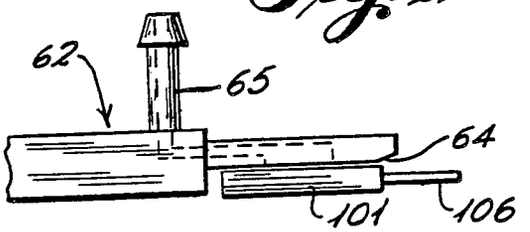

Fig.14

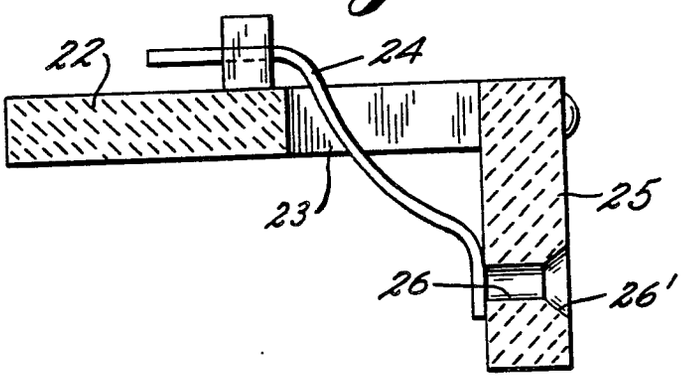

Fig.15

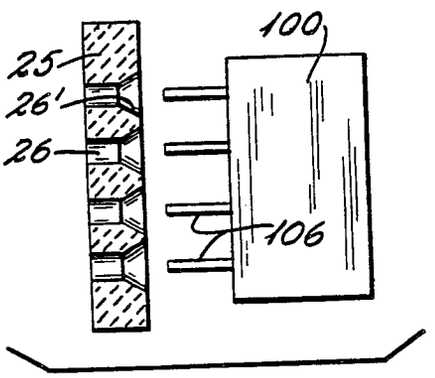

Fig.16

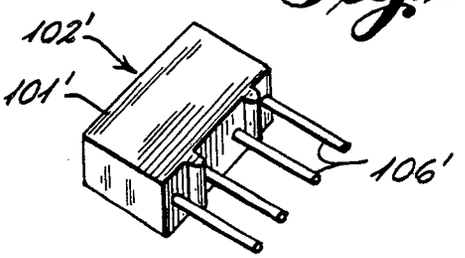

Fig.17